IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): de Wit Application No.: 10/661,444 Filed: 9/12/2003 Title: Pressurized Containers and Method for Making Thereof Attorney Docket No.: GEPL.P-128 Customer No.: 57381	Group Art Unit: 1754 Examiner: Paul A. Wartalowicz Confirmation No: 7822

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Further to the response filed today September 6, 2007 to the Office Action mailed March 6, 2007 for the above-captioned application attached is Exhibit A.

Respectfully submitted,

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PET film (biaxially oriented)

From Wikipedia, the free encyclopedia

Biaxially-oriented polyethylene terephthalate (boPET) polyester film is used for its high tensile strength, chemical and dimensional stability, transparency, gas and aroma barrier properties and electrical insulation.

A variety of companies manufacture boPET and other polyester films under different trade names. In the US and Britain, the most well-known trade names are **Mylar** and **Melinex**.

History and manufacture

Biaxially oriented PET film was developed in the mid-1950s, originally by DuPont and ICI. In 1960 and 1964 NASA launched the Echo satellites, 100-foot diameter (30-meter dia.) balloons of metallized 0.005 inch (0.13 mm) thick boPET film.

The manufacturing process (http://www.ampef.com/technology2.html) begins with a film of molten PET being extruded onto a chill roll, which quenches it into the amorphous state. It is then biaxially oriented by drawing. The most common way of doing this is the sequential process, in which the film is first drawn in the machine direction using heated rollers and subsequently drawn in the transverse direction, i.e.orthogonally to the direction of travel, in a heated oven. It is also possible to draw the film in both directions simultaneously, although the equipment required for this is somewhat more elaborate. Draw ratios are typically around 3 to 4 in each direction.

Once the drawing is completed, the film is "heat set" or crystallized under tension in the oven at temperatures typically above 200° C. The heat setting step prevents the film from shrinking back to its original unstretched shape and locks in the molecular orientation in the film plane. The orientation of the polymer chains is responsible for the high strength and stiffness of biaxially oriented PET film, which has a typical Young's modulus of about 4 GPa. Another important consequence of the molecular orientation is that it induces the formation of many crystal nuclei. The crystallites that grow rapidly reach the boundary of the neighboring crystallite and remain smaller than the wavelength of visible light. As a result, biaxially oriented PET film has excellent clarity, despite its semicrystalline structure.

If it were produced without any additives, the surface of the film would be so smooth that layers would adhere strongly to one another when the film wound up, similar to the sticking of clean glass plates when stacked. To make handling possible, microscopic inert

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inorganic particles are usually embedded in the PET to roughen the surface of the film.

Biaxially oriented PET film can be aluminized by evaporating a thin film of metal onto it. The result is much less permeable to gasses (important in food packaging) and reflects up to 99% of light, including much of the infrared spectrum. For some applications like food packaging, the aluminized boPET film can be laminated with a layer of polyethylene, which provides sealability and improves puncture resistance. The polyethylene side of such a laminate appears dull and the PET side shiny.

Metallized nylon (or "foil") balloons used for floral arrangements and parties are often called "Mylar", one of the trade names for boPET film.

Other coatings, such as conductive indium tin oxide (ITO), can be applied to boPET film by sputter deposition.

Uses for boPET film

Uses for boPET polyester films include, but are not limited to:

- Packaging and food contact applications
  - Laminates containing metallized boPET film protect food against oxidation and aroma loss, achieving long shelf life. Examples are coffee "foil" packaging and pouches for convenience foods.
  - Attractive glossy or matte surfaces on the outside of packages are achieved using boPET film.
  - White boPET film is used as lidding for dairy goods such as yoghurt.
  - Clear boPET film is used as lidding for fresh or frozen ready meals. Due to its excellent heat resistance, it can remain on the package during microwave or oven heating.
  - Roasting bags

- Covering over paper
  - A clear overlay on a map, on which notations, additional data, or copied data, can be drawn without damaging the map
  - Metallized boPET is used as a mirror-like decorative surface on some book covers, T-shirts, and other flexible cloths.
  - Protective covering over buttons/pins/badges
  - The glossy top layer of a Polaroid SX-70 photographic print
  - As a backing for very fine sandpaper
  - boPET film is used in bagging comic books, in order to best protect them during storage from environmental conditions (moisture, hot and cold) that would otherwise cause paper to slowly deteriorate over time. This material is used for archival quality storage of documents by the Library of Congress

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(http://lcweb.loc.gov/preserv/supply/specific.html)

- Insulating material
  - An electrical insulating material
  - As base material for audio or video magnetic recording tapes
  - Insulation for houses and tents in *cold* environments, covering the inner walls with the metallized surface facing *inward*, thus reflecting heat *back into* the space
  - Insulation for houses and tents in *hot* environments, covering the outer walls with the metallized surface facing *outward*, thus reflecting heat *away from* the space
  - Five layers of metallized boPET film in NASA's spacesuits make them radiation resistant and keep astronauts warm.
  - Metallized boPET film "emergency blankets" conserve a shock victim's body heat.
  - As a thin strip to form an airtight seal between the control surfaces and adjacent structure of aircraft, especially sailplanes
  - Light insulation for indoor gardening

- Solar and marine applications
  - Solar sails as an alternative means of propulsion for spacecraft such as Cosmos 1
  - Metallized boPET solar curtains reflect sunlight and heat away from windows.
  - Aluminized, as an inexpensive solar eclipse viewer, although care must be taken, because invisible fissures can form in the metal film, reducing its effectiveness.
  - High performance sails for sailboats

- Electronic / acoustic applications
  - Very thin boPET film is often used as the diaphragm material in electrostatic loudspeakers and electret microphones.
  - boPET film has been used in the production of banjo & drumheads since 1958 due to its durability and acoustical properties when stretched over the bearing edge of the drum. They are made in single- and double-ply versions, with each ply being between 2 mils and 10 mils (0.05 – 0.25 mm) in thickness, with a clear or opaque surface, originally used by the company EVANS.
  - boPET film is used as the substrate in practically all magnetic recording tapes.
  - Metallized boPET film, along with other plastic films, is used as a dielectric in foil capacitors.
  - Clear boPET bags are used as packaging for audio media such as compact discs and vinyl records.

- Graphic arts
  - Often engineering plans or architectural drawings are plotted onto sheets of

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boPET film. The boPET sheets become legal documents from which copies or blueprints are made. boPET sheets are more durable and can withstand more handling than bond paper.
    - Overhead transparency film for photocopiers or laser printers (boPET film withstands the high heat).

- Other
    - For materials in kites
    - Covering glass to decrease probability of shattering
    - In theatre effects as confetti.
    - As the adhesive strip to attach the string to a teabag

External links

- *Plastics: Background Information for Teachers*. by The American Plastics Council (HTML format) (http://www.teachingplastics.org/hands_on_plastics/intro_to_plastics/teachers.html) or (PDF format) - 1.9MB) (http://www.teachingplastics.org/hands_on_plastics/pdf/teachers.pdf), which includes the "chasing arrow" recycling symbols (PET is #1) and a description of plastics.
- Links to most manufacturers of boPET films are available at the AMPEF website (http://www.ampef.com/)

Retrieved from "http://en.wikipedia.org/wiki/PET_film_%28biaxially_oriented%29"

Categories: Plastics | Dielectrics

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